

### Drawings

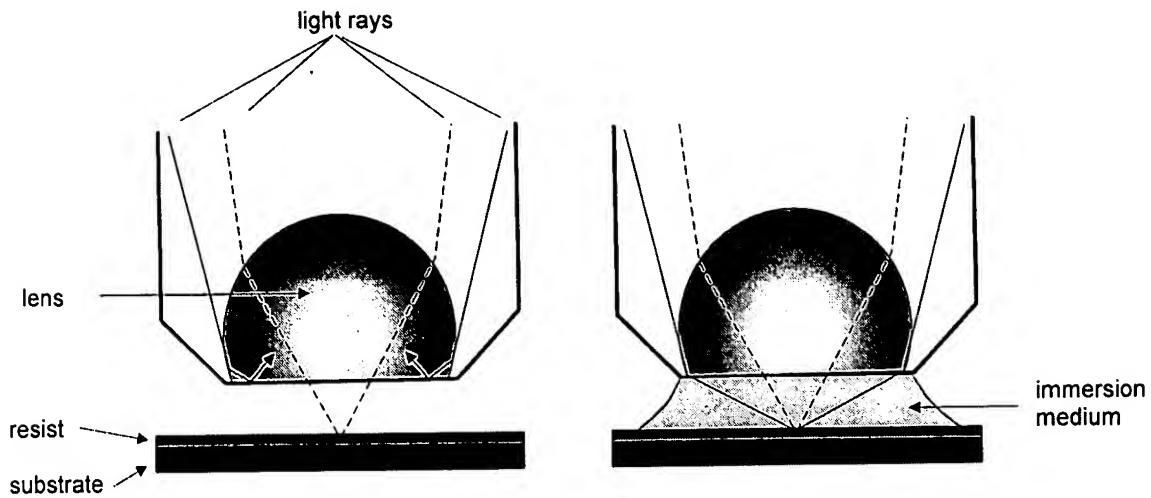


Figure 1: Difference in the optical path of light rays entering at the extreme edge of a lens for air and an immersion medium of higher refractive index. The rays show total internal reflection in air but propagate to the wafer in the case of immersion lithography.

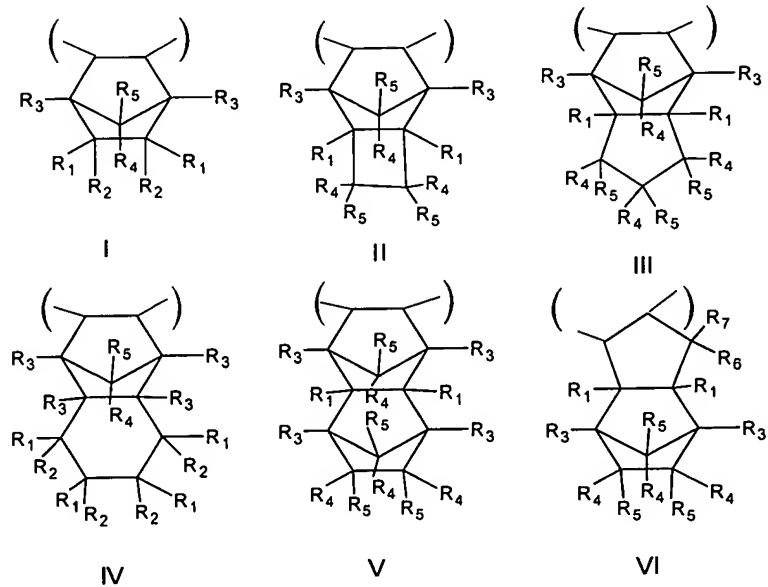


Figure 2: Possible repeat units of barrier polymer containing multicyclic repeat units that form the backbone of a polymer chain in which at least one of the substituents comprises an ionizable group, to give the unit in Structure 1.

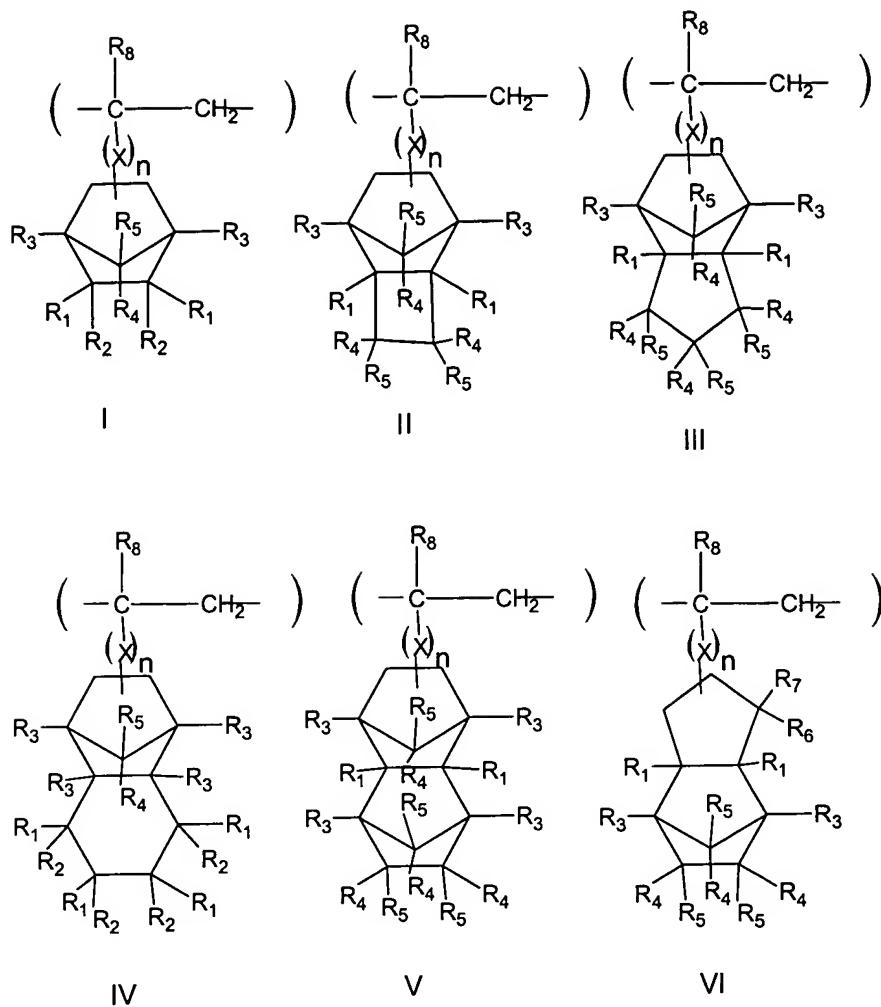


Figure 3: Repeat units of barrier polymer containing multicyclic repeat units that form the backbone of a polymer chain in which at least one of the substituents comprises an ionizable group, to give the unit in Structure 1.

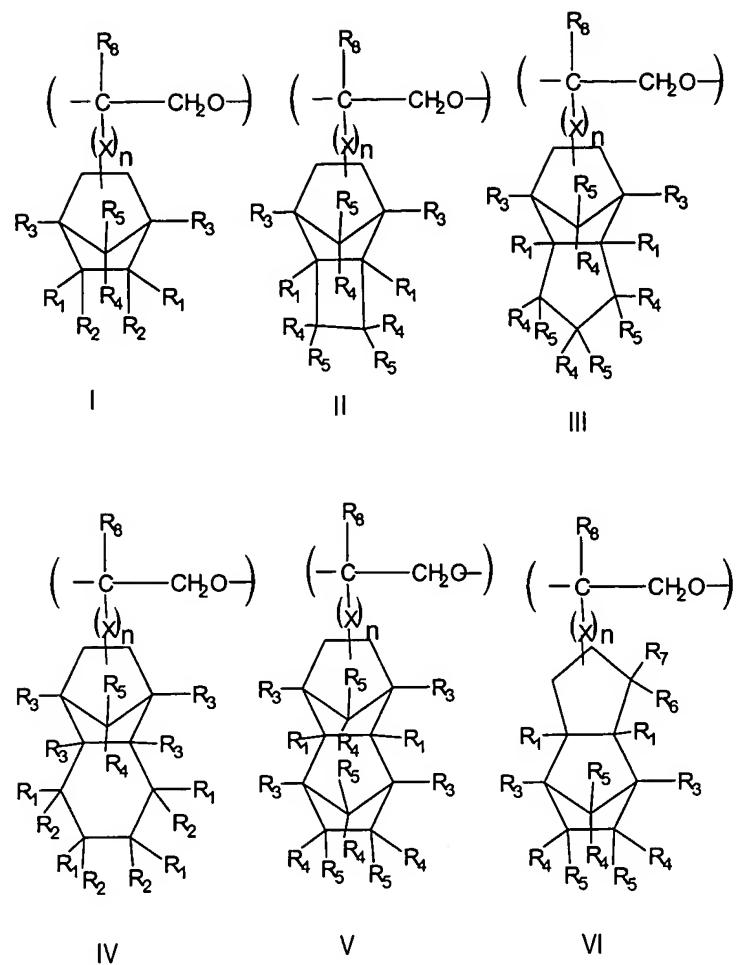


Figure 4: Repeat units of barrier polymer containing multicyclic repeat units that form the backbone of a polymer chain in which at least one of the substituents comprises an ionizable group, to give the unit in Structure 1.

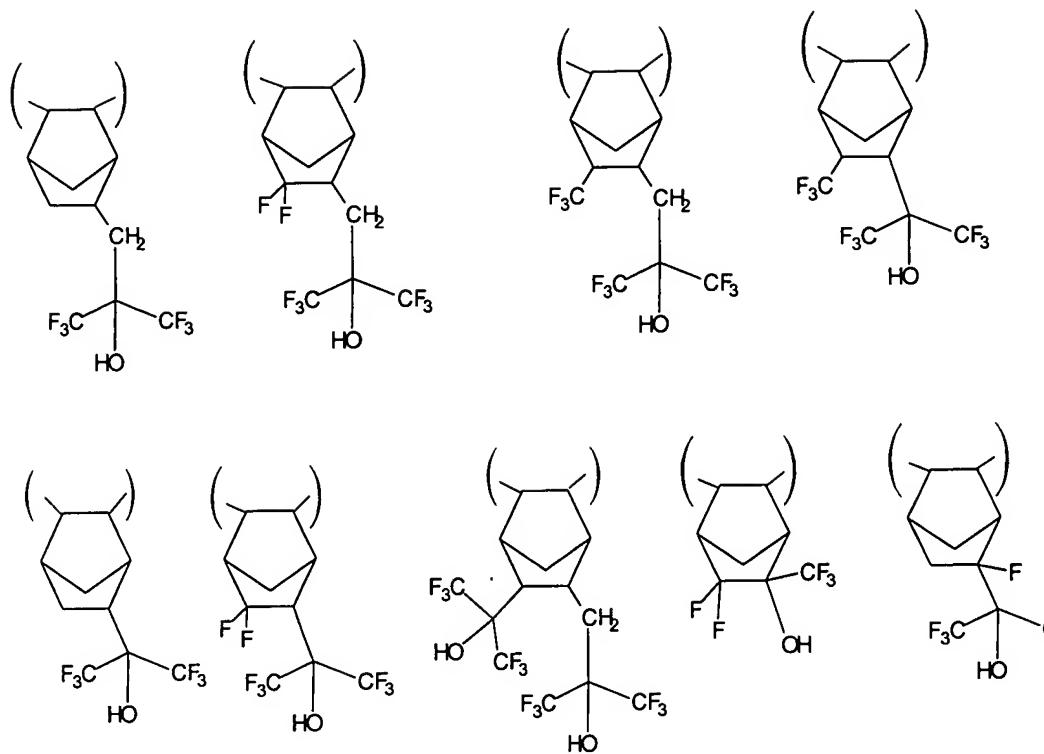
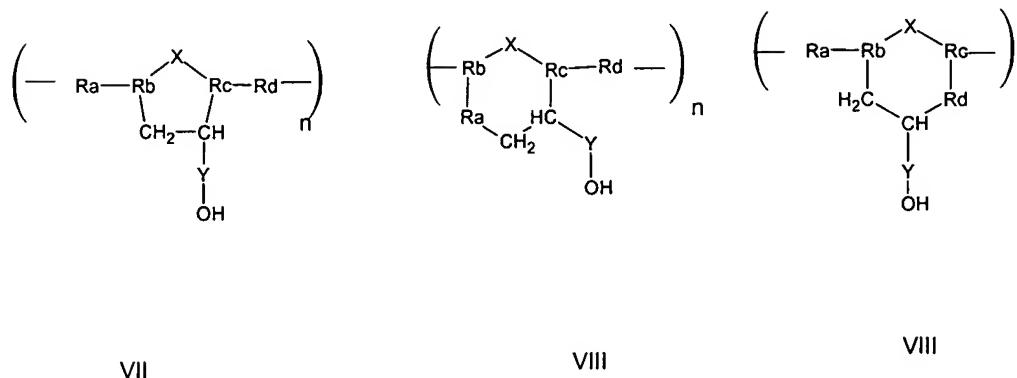
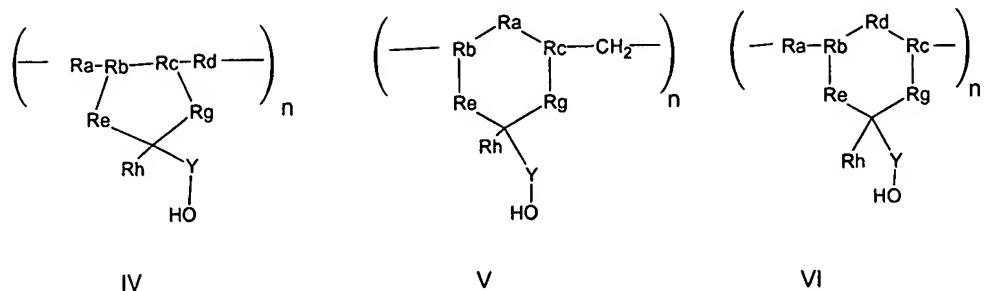
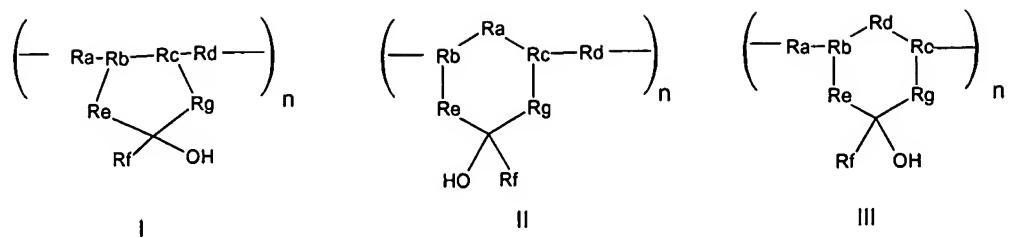


Figure 5: Examples of fluoroalcohol bearing norbornene repeat units.



Rf = fluoroalkyl group C1-C8

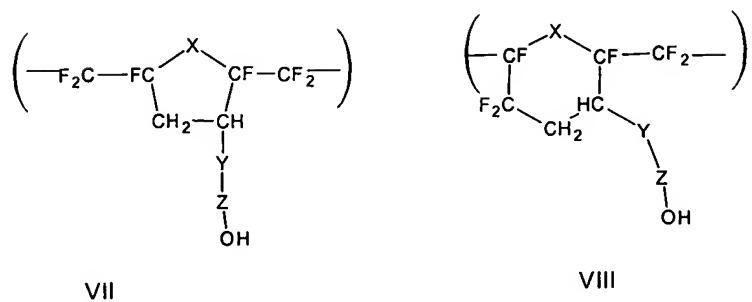
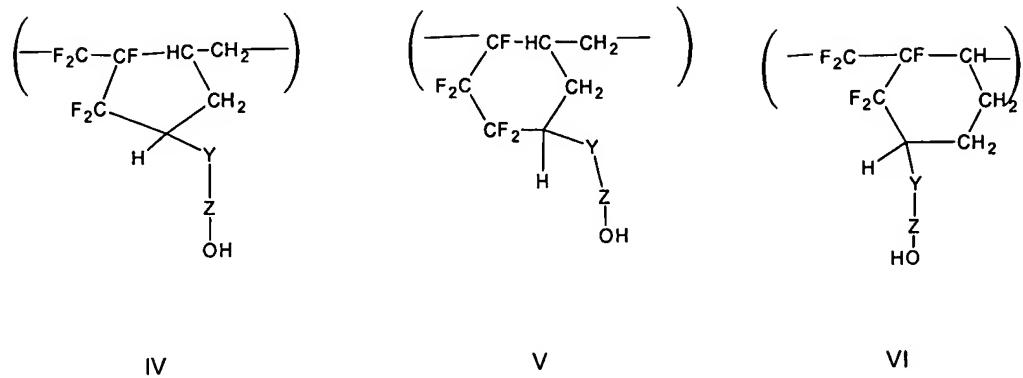
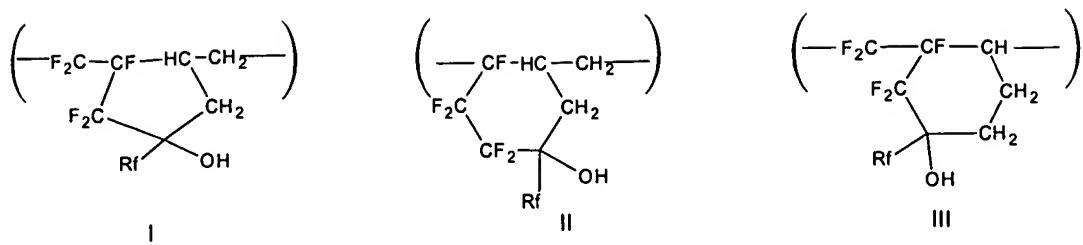
Ra, Rb, Rc, Rd, Re, Rg, Rh = alkyl, fluoroalkyl or fluorocycloalkyl,

Also, Ra-Re and Rg can be substituted with alkyl, fluoroalkyl, cycloalkyl, fluorocycloalkyl or with a spirofluoroalkyl or spiroalkyl substituent

Y=  $(CR_1R_2)_n - (CR_3kR_4)_m - OH$   $l=0-10$ ,  $m=0-10$ ,  $R_{ij}$  are independently  $=H$ ,  $F$ , alkyl, fluoroalkyl or cyclofluoroalkyl.  $R_k$  and  $R_l$  are independently, fluoroalkyl or cyclofluoroalkyl

X= CF<sub>3</sub>, O

Figure 6: Monocyclic polymers having pendant hydroxy groups



$\text{Rf}$  = fluoroalkyl group C1-C8

$\text{Y}$  = alkyl or fluoroalkyl spacer group C0-C8

$\text{Z} = \text{C}(\text{C}_n\text{F}_{2n+1})_2, \text{C}(\text{C}_n\text{F}_{2n+1})(\text{C}_n\text{H}_{2n+1}),$   
 $n=1-12$

$\text{X} = \text{CF}_2, \text{O}$

Figure 7: Partially fluorinated monocyclic polymers having pendant alcohol groups

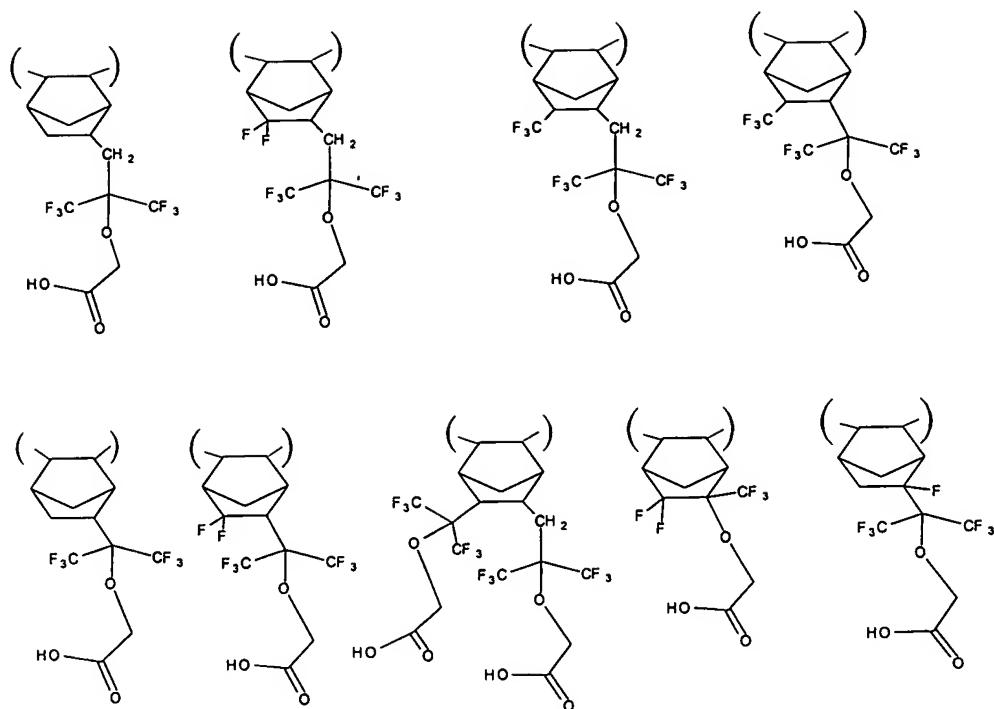


Figure 8: Examples of alkylcarboxylic acid capped fluoroalcohol bearing norbornene repeat units.

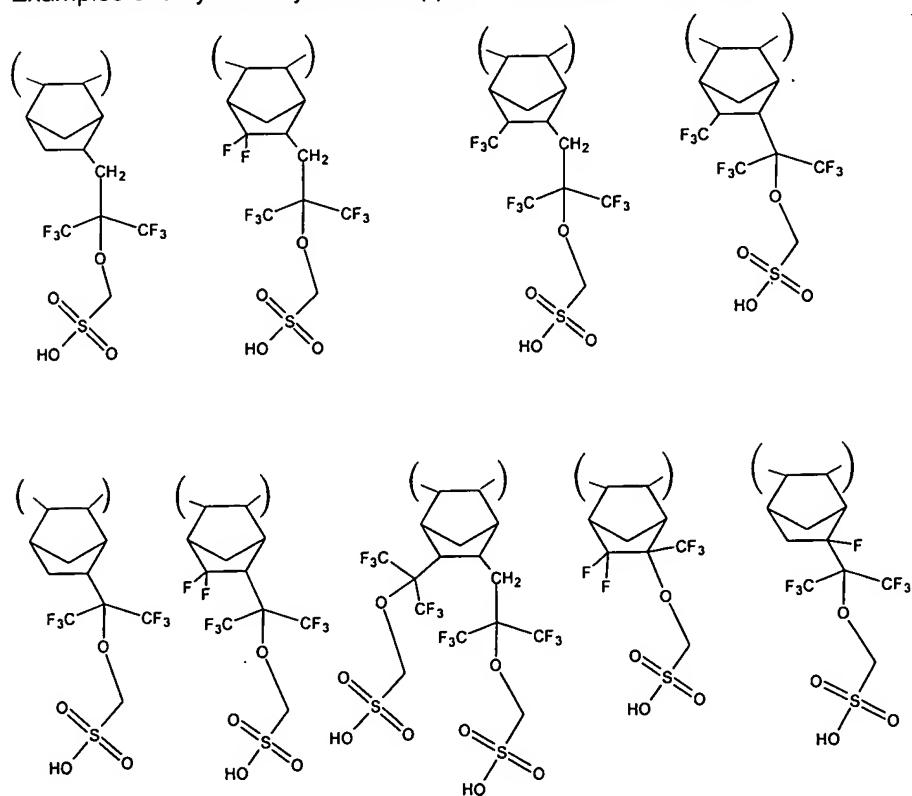
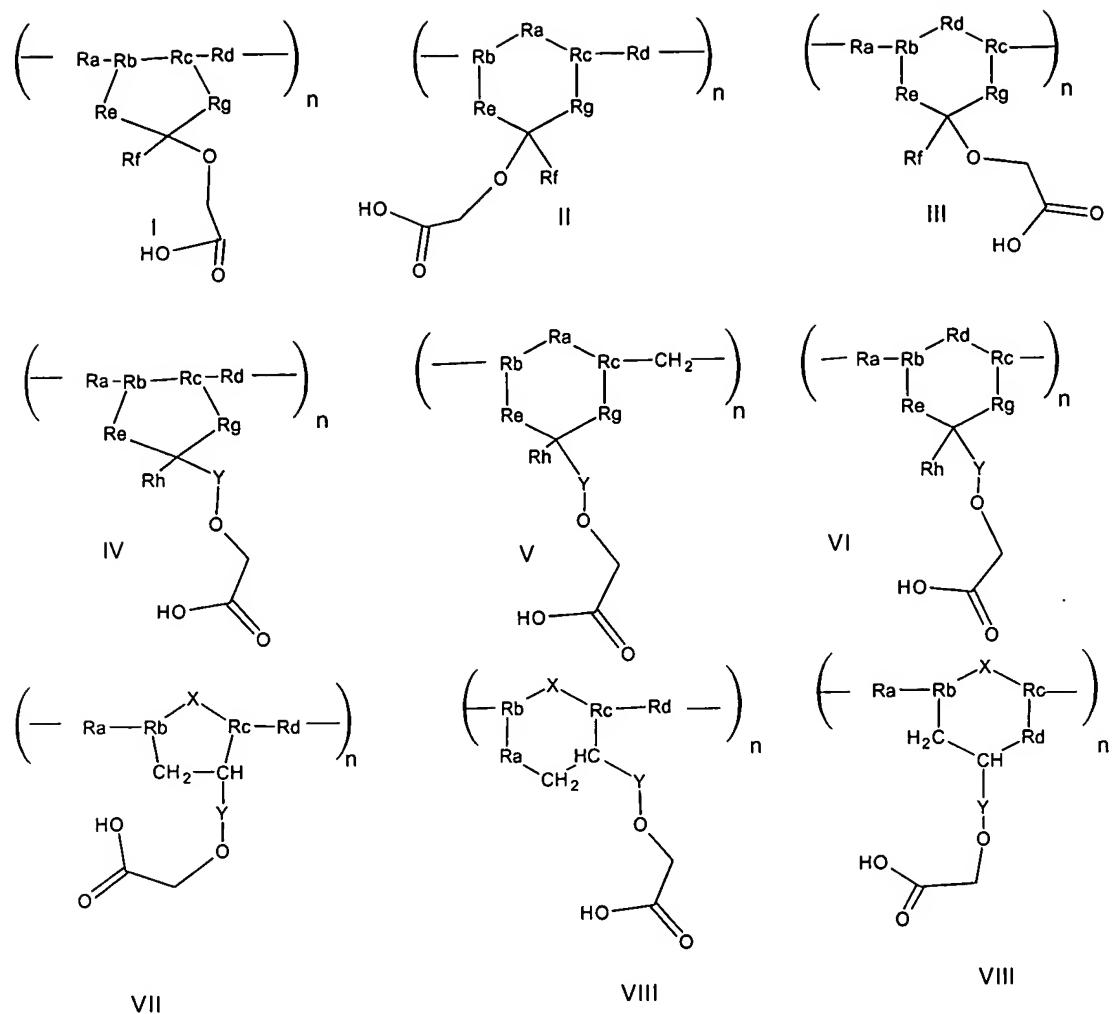


Figure 9: Examples of alkylsulfonic acid capped fluoroalcohol bearing norbornene repeat units.



Rf = fluoroalkyl group C1-C8

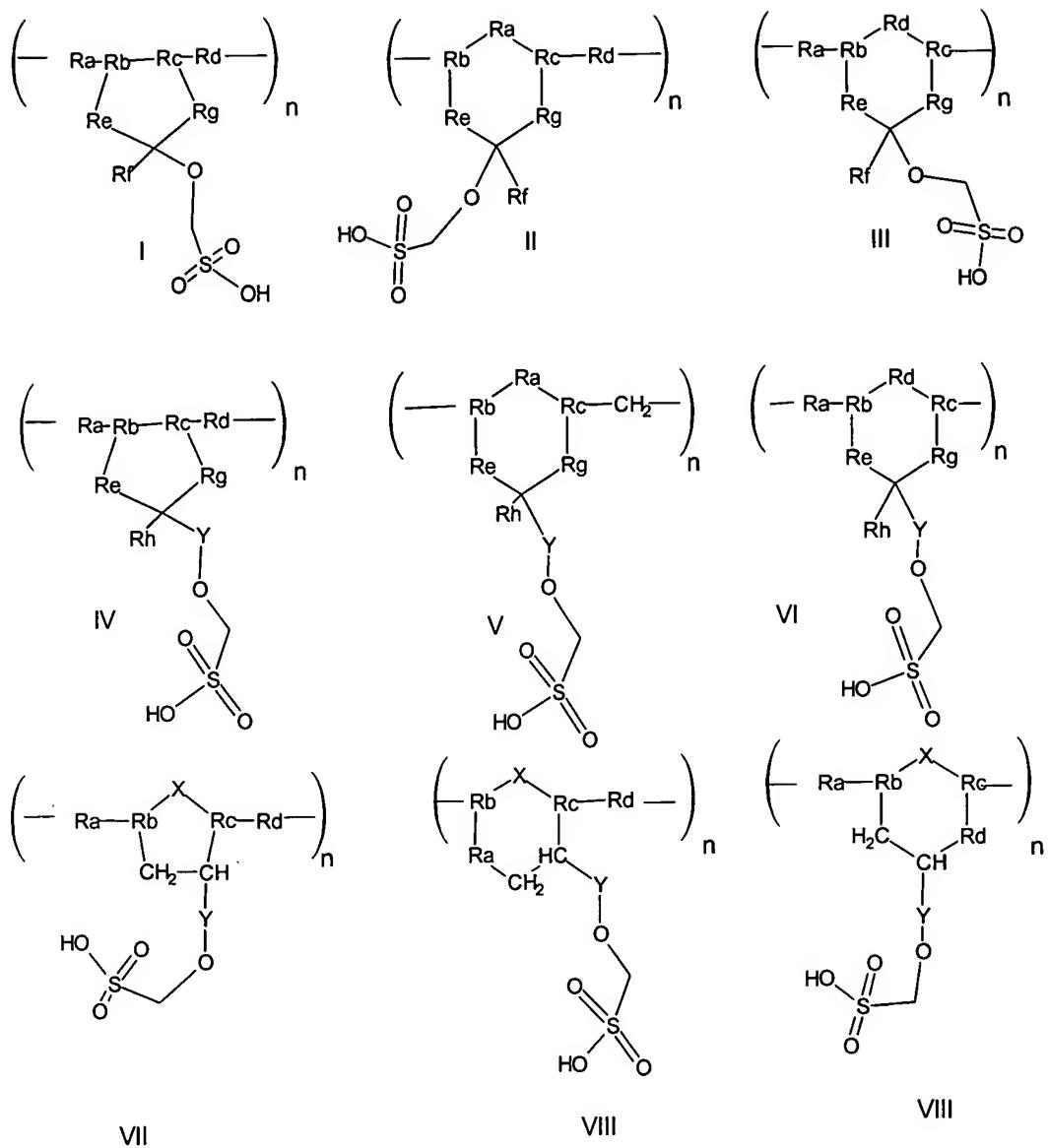
Ra, Rb, Rc, Rd, Re, Rg, Rh = alkyl, fluoroalkyl or fluorocycloalkyl,

Also, Ra-Re and Rg can be substituted with alkyl, fluoroalkyl, cycloalkyl, fluorocycloalkyl or with a spirofluoroalkyl or spiroalkyl substituent

Y=  $(CR_iR_j)_n -(CR_kR_l)_m -OH$  I=0-10, m=0-10, Rij are independently =H, F, alkyl, fluoroalkyl or cyclofluoroalkyl. Rk and Rl are independently, fluoroalkyl or cyclofluoroalkyl

X= CF<sub>2</sub>, O

Figure 10: Generic monocyclic polymers repeat units having pendant hydroxy groups capped with methylcarboxylic acid moieties.



Rf = fluoroalkyl group C1-C8

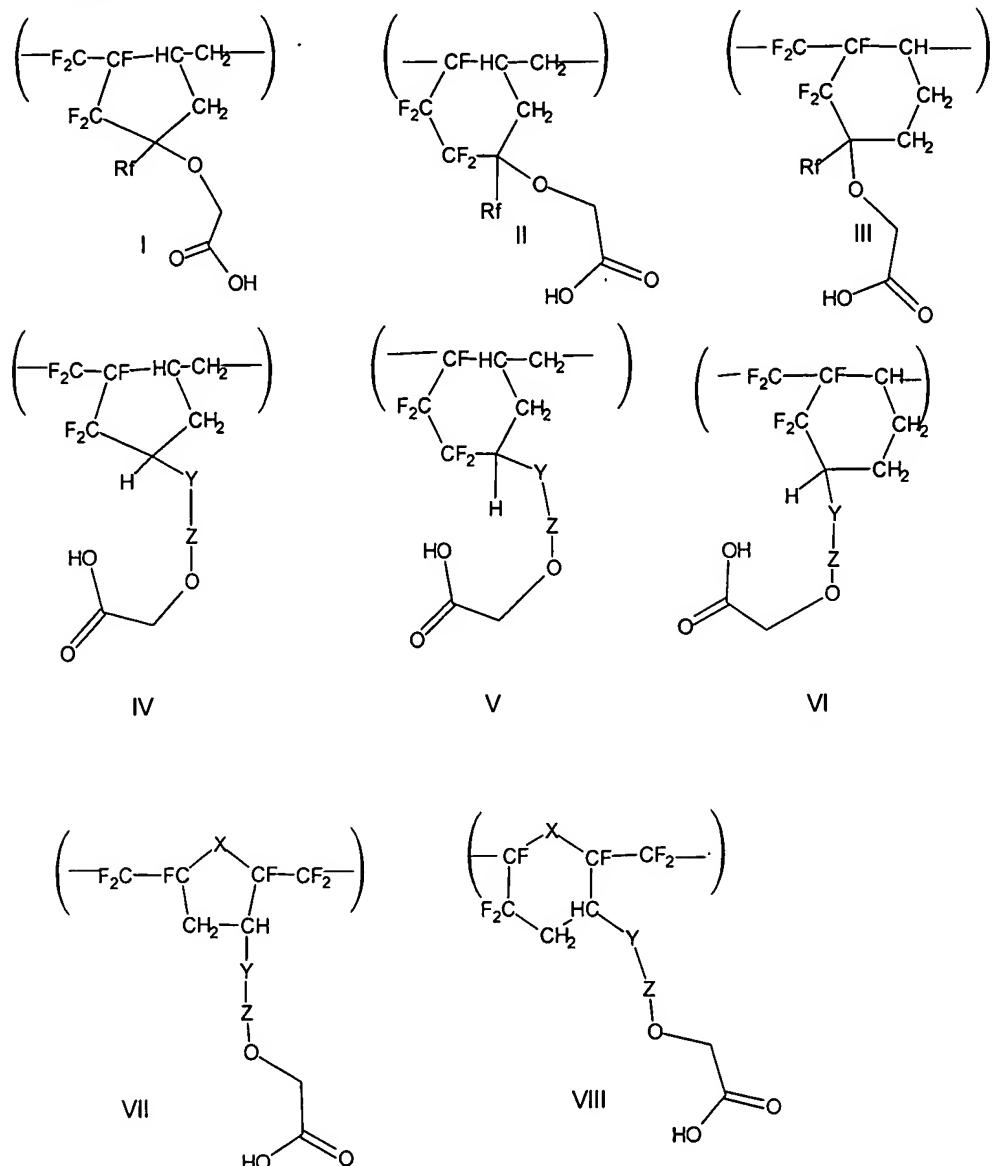
Ra, Rb, Rc, Rd, Re, Rg, Rh = alkyl, fluoroalkyl or fluorocycloalkyl,

Also, Ra-Re and Rg can be substituted with alkyl, fluoroalkyl, cycloalkyl, fluorocycloalkyl or with a spirofluoroalkyl or spiroalkyl substituent

Y=  $(CRiRj)_n - (CRkRl)_m - OH$  I=0-10, m=0-10, Rij are independently =H, F, alkyl, fluoroalkyl or cyclofluoroalkyl. Rk and Rl are independently, fluoroalkyl or cyclofluoroalkyl

X=  $CF_2, O$

Figure 11: Generic monocyclic polymers repeat units having pendant hydroxy groups capped with methylsulfonic acid moieties



Rf = fluoroalkyl group C1-C8

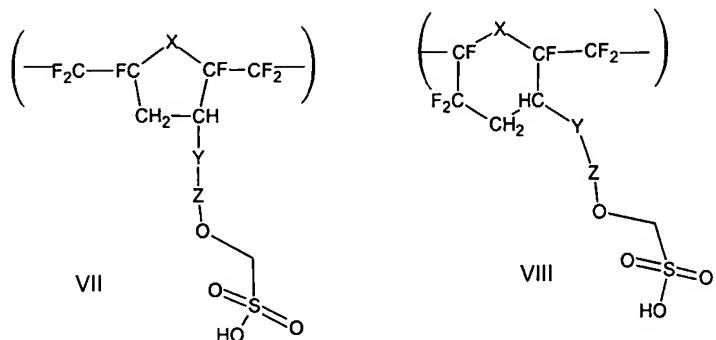
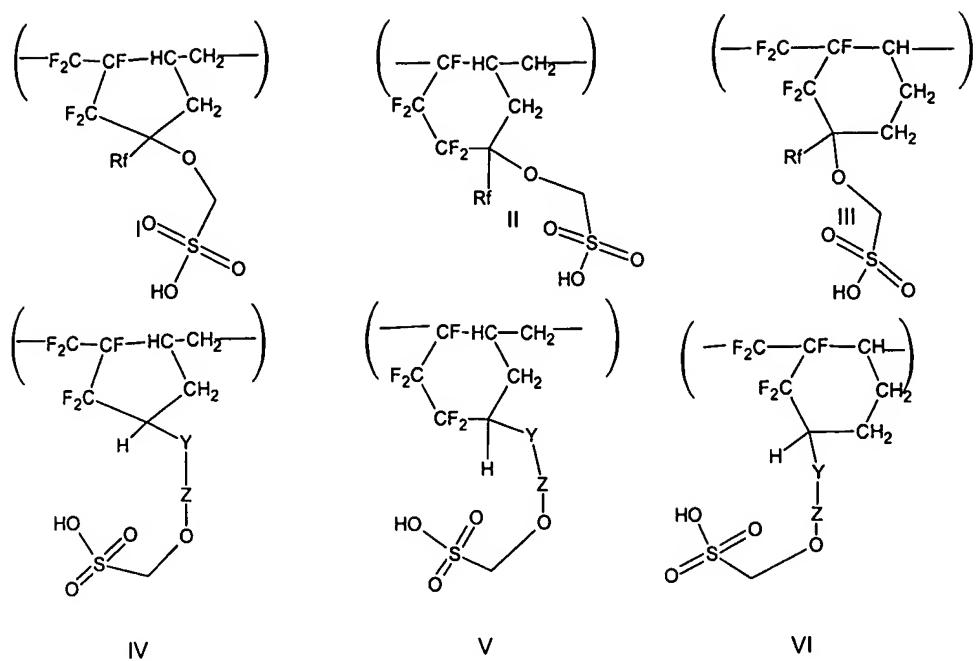
Y= alkyl or fluoroalkyl spacer group C0-C8

$$Z = C(C_n F_{2n+1})_2, \quad C(C_n F_{2n+1})(C_n H_{2n+1}),$$

n=1-12

X= CF<sub>3</sub>, O

Figure 12: Partially fluorinated monocyclic polymers repeat units having pendant alcohol groups capped with alkylcarboxylic acid groups.



Rf = fluoroalkyl group C1-C8

Y= alkyl or fluoroalkyl spacer group C0-C8

$$Z = C(C_n F_{2n+1})_2, \quad C(C_n F_{2n+1})(C_n H_{2n+1}),$$

$n=1-12$

X = CF<sub>3</sub>, O

Figure 13: Partially fluorinated monocyclic polymers repeat units having pendant alcohol groups capped with alkylsulfonic acid groups



Figure 14: Examples of comonomeric repeat units.